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STATE OF ALASKA
Keith H. Miller, Governor



ANNUAL REPORT OF PROGRESS, 1968 - 1969
FEDERAL AID IN FISH RESTORATION PROJECT F-9-1
SPORT FISH INVESTIGATIONS OF ALASKA

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INTRODUCTION

This report of progress involves the findings and work accomplished under the State of Alaska, Federal Aid in Fish Restoration, Project F-9-1, "Sport Fish Investigations of Alaska".

The work conducted during this reporting period constitutes effort on nine separate studies which are crucial in evaluating the sport fishing resources of the State. Recreational demands have necessitated broadening our knowledge of the fishery. All 20 jobs were of continuing nature enabling the Department to keep abreast of present and future impacts on certain fish species. Specifically, the work included work on inventory and cataloging of the sport fish and sport fish waters of the State, sport fishery creel census and access. Special emphasis was given to Dolly Varden, silver salmon, anadromous fish, grayling, salmon, sheefish, pike, and char. The information gathered has provided supporting documentation for better fish management and a basis for necessary future investigations.

The subject matter contained in these reports may be inconclusive. The findings and interpretation are subject to re-evaluation as the work progresses.

RESEARCH PROJECT SEGMENT

STATE: ALASKA Name: Sport Fish Investigations of Alaska.
Project No.: F-9-1 Title: Investigation and Cataloging of Sport Fish and Sport Fish Waters in Interior Alaska-Char in Northwestern Alaska.
Job No.: 15-A

Period Covered: July 1, 1968 to June 30, 1969.

ABSTRACT

This report presents the results of a study on anadromous Arctic char, Salvelinus alpinus, from the Wulik and Kivalina Rivers in northwestern Alaska which was initiated in August, 1968. Emphasis was placed on collecting life history, subsistence and sport fishery information.

Preliminary results indicate that Wulik River char have a growth rate somewhat more rapid than do anadromous Arctic char in other areas where studies have been conducted.

The majority of char which recently returned to freshwater after a summer in saltwater had not been feeding.

An aerial count of char in the Wulik and Kivalina Rivers revealed an estimated 46,000 char in the Kivalina and 180,500 to 225,600 char in the Wulik.

Gill raker counts indicate that Wulik River char are Arctic char, S. alpinus, rather than Dolly Varden char, S. malma, as has been frequently reported in the literature.

Native subsistence fishermen took an estimated 120,000 pounds of char (49,500 fish) from the Wulik River with seines during the autumn of 1968.

An estimated 50 to 60 sport fisherman trips were made to the Wulik River in 1968.

Information on char from the Nome and Anaktuvuk Pass area is presented.

RECOMMENDATIONS

1. Expand the tagging program in the Kivalina-Kotzebue area to determine char migration patterns.
2. Estimate the population of char in the Wulik River by aerial surveys and investigate the feasibility of using a sonar counter for population enumeration on the Wulik River.
3. Sample char in the Kivalina-Kotzebue area to collect age, growth, feeding, and age at maturity information.
4. Collect information on the timing of Wulik River char migrations.

5. Monitor the Wulik River subsistence fishery on a year-around basis.
6. Continue to determine the utilization of the Wulik River by sport fishermen.
7. Initiate a taxonomy study on Wulik River char.
8. While the emphasis of char life history studies should be in the Kivalina-Kotzebue area, age and growth, age at maturity, population size, and taxonomic information should be collected from other Arctic and sub-Arctic areas such as the Anaktuvuk and Colville Rivers and Seward Peninsula streams.

OBJECTIVES

1. To collect information on the Wulik River subsistence fishery.
2. To determine the utilization of the Wulik River by sport fishermen.
3. To sample char and obtain information on age, growth, age at maturity, and feeding.
4. To estimate the populations of char in the Wulik and Kivalina Rivers.
5. To collect additional life history and taxonomic information from the Wulik and other streams of Arctic and sub-Arctic Alaska whenever feasible.

TECHNIQUES USED

During August and September, 1968, 139 Arctic char from the Wulik and Kivalina Rivers which were collected from native gill nets, seines, and on sports gear, were sampled for information on length, weight, age, sex, maturity, and feeding.

The fork length of the char was measured with a steel metric tape. Some of the larger males exhibited considerable kype development. These fish were measured from the upper jaw to the fork of the tail.

The fish were weighed with spring-type scales (15- and 50-pound capacity).

Otoliths were collected from 139 char for age determination. The methods used were the same as those described by Heiser (1966) for Lake Eva Dolly Varden, except xylene rather than water and household detergent was used to immerse the otoliths while they were being read.

The fish were examined for sex and maturity. Although it was usually possible to sex the larger fish externally from kype development, the gonads were examined on all fish. If the fish would not have spawned soon, they were judged immature. Ovaries were examined for residual eggs.

Stomachs were examined for contents.

The population of char in the Wulik and Kivalina Rivers was estimated from an aerial survey on September 16, 1968.

Eighty-three char captured in a native seine on September 25, 1968, were tagged with yellow spaghetti tags furnished by the Commercial Fish Division, Anchorage.

Meristic counts were made on char from several areas. All counts follow Hubbs and Lagler (1958).

Background information on Kivalina and the subsistence char fishery was obtained from interviews with village residents.

The author accompanied native fishermen during their upriver seining activities. At the end of a day's fishing, each of the four crews removed their catch from the boats with galvanized wash tubs. All crews used tubs of the same size (24 3/4-inch top diameter, 11 1/4-inch height, 21-inch bottom diameter). The tubs held an average of 89 unfrozen fish per tub (from a sample of 35 tubs, all fish sizes included). A tub of unfrozen fish weighed an average of 209 pounds (from a sample of eight tubs).

Because of the distance between fishing sites it was not possible to visit each camp at the end of a day's fishing. It was necessary to rely upon the people to keep records of their catch. One member in each crew kept records of the number of tubs of fish.

To obtain information on the length frequency of the catch, a random sample of 462 char was collected from the catch of a crew camped 26 miles upriver.

Information on the Wulik River sport fishery was obtained from interviews with Kotzebue charter pilots, Kotzebue sport fishermen and Kivalina residents.

FINDINGS

In late August, 1968, a study was begun on the anadromous char of the Wulik and Kivalina Rivers in northwestern Alaska. The two rivers empty into the Chukchi Sea near the village of Kivalina, 67°54'N and 160°31'W. It was known that the Wulik River had good numbers of char, supported a large subsistence fishery, and was an excellent stream for sport fishing. Also, it was felt that information on Arctic char collected from the Wulik and Kivalina Rivers would be useful during future char studies in other areas.

Study Area

Physical and biological characteristics of the Wulik and Kivalina Rivers are compared in Table 1. Because more subsistence and sport fishing occurs on the Wulik, much more time was spent on that river.

Age and Growth of Wulik River Char

In the autumn of 1968, 139 char from the Wulik River subsistence catch were sampled as part of a preliminary age and growth study. Otoliths were used to age the fish. Nine sets of otoliths taken from larger char (all over 375 mm) were unreadable. Results are presented in Table 2.

TABLE 1 - Comparison of Physical and Biological Characteristics of Wulik and Kivalina Rivers

	Wulik River	Kivalina River*
Length	89 mi. (approx.)	64 mi. (approx.)
Size of watershed	860 sq. mi. (approx.)	680 sq. mi. (approx.)
Velocity**	Fairly rapid (1/2 FS)	Fairly rapid (1/2 FS)
Color	Clear	Clear
Frequency of pools	Approx. 50% pools to rapids.	No data
Size of pools	Usually greater width than average stream width. Some more than 15 feet.	Some deep pools in lower reaches
Bottom	Upper areas mostly coarse gravel. Percentage of fine gravel and sand increases toward mouth (dark color).	Fine gravel sand and silt near mouth
Shade	Very little--only few overhanging banks and bushes.	Apparently very little
Miscellaneous	Numerous wide gravel bars upstream.	Few gravel bars
Vegetation**	Algae only and quite sparse.	Algae only and quite sparse.
Invertebrates	Incomplete survey but apparently not abundant. Trichoptera and Isopod, <u>Mesidothea entomon</u> collected.	No data

**Observations on lower eight miles only.

**From observations made in Autumn, 1968.

A survey of the literature on Arctic char age and growth studies indicates a wide discrepancy in growth rates (Andrews and Lear, 1956; Grainger, 1953; Sprules, 1952). The growth of Wulik River char, although very slow when compared to chum salmon, Oncorhynchus keta, from the Kotzebue area^{1/}, is apparently more rapid than in other areas where Arctic char age and growth has been studied. Wulik River char growth rates seem closest to those reported by Sprules (1952) from northwestern Hudson Bay, Canada. These are only tentative conclusions, as more study is necessary

^{1/}Commercial Fish biologist Mike Geiger stated in personal communication that four-year-old chum salmon predominate in the Kotzebue salmon fisheries and their average weight is 9.7 pounds.

TABLE 2 - Age, Mean Length and Length Range of Char Sampled from Wulik River, Autumn, 1968.

<u>Age Group</u>	<u>No.*</u>	<u>Mean Fork Length (mm)</u>	<u>Range (mm)</u>
III	16	284	255 - 370
IV	38	341	255 - 495
V	23	349	264 - 452
VI	13	475	284 - 575
VII	14	564	354 - 735
VIII	12	628	545 - 785
IX	9	645	545 - 745
X	2	607	605 - 610
XI	1	670	---
XII	1	600	---
XIII	--	--	---
XIV	--	--	---
XV	--	--	---
XVI	<u>1</u>	<u>835</u>	<u>---</u>
TOTAL	130	433	255 - 785

*Nine pairs of otoliths were unreadable.

Age at Maturity of Wulik River Char

The age at maturity of Wulik River char remains unknown. Of 139 char samples from 255 to 915 mm and .25 to 17.5 pounds, no sexually mature fish were obtained nor were any sexually mature fish noted among the autumn native subsistence seine catch. None of the females sampled had residual eggs. It was often possible to sex the larger fish externally from head and kype development; however, these fish did not exhibit the typical char spawning coloration. Non-consecutive spawning probably occurs in Wulik River char. It is reported to occur in Canadian char (Hunter, 1966, and Grainger, 1953). This would help to explain why some of the large fish exhibited some secondary sex characteristics (kype development) but were not ready to spawn and had not recently spawned.

Feeding of Wulik River Char

Stomach samples were taken from 52 Wulik River char (September 2 through September 26, 1968). Of that number, 49 stomachs were empty and three stomachs contained unidentifiable debris. Some food was available as the stomachs of four grayling taken from the Wulik during the same period all contained food; one had four caddisfly larvae, the other three had unidentifiable insect remains.

Population Estimate

On September 16, 1968, Ron Regnart, Commercial Fish management biologist, flew aerial surveys of the Wulik and Kivalina Rivers in a Cessna 180 aircraft. The details and results of the surveys are presented in Table 3.

TABLE 3 - Population Estimate, Wulik and Kivalina Rivers, September 16, 1968.

	<u>Wulik River</u>	<u>Kivalina River</u>
Time	1115 - 1230	1329 - 1353
Bottom	Light gravel or sand	Light gravel or sand
Weather	Overcast partially-badly obscuring counts.	Haze and overcast partially obscuring count.
Wind	Riffle, reflection and glare partially obscuring counts.	Riffle, reflection and glare partially obscuring counts.
Water	Clear	Clear
Section Surveyed and Remarks	From 10 miles above Ikalukrok Creek to 3 miles above village. Greatest concentration from mouth of Ikalukrok Creek to 10 miles downstream. Largest fish in upper river. Many schools bank to bank.	Mouth to about 10 miles above Jarvis Mountain (about 2/3 size Wulik). Concentration of fish from about Mile 10 - 20.
Over-all Survey Rating	Poor 40 - 50%	Fair 60%
Count	90,235	27,460
Estimated Population of Char	180,500 - 225,600	46,000

Tagging

Just before freeze up on September 25, 1968, 83 char ranging in length from 267 to 622 mm were tagged with spaghetti tags and released at a site 30 miles up the Wulik River. All fish were in good condition when released. At this writing none of the tagged char have been recovered.

Taxonomy of Wulik River Char

A survey of the literature reveals that there is confusion as to whether the Wulik River char are Arctic char, Salvelinus alpinus, or Dolly Varden char, S. malma. The early commercial fishery reports from the Kotzebue area listed catches of Dolly Varden (Alaska Fishery and Fur Seal Industries, 1909-1956). Scofield (1899) called the char that he collected near Point Hope S. malma. Saario and Kessel (1966) identified the Wulik River char as S. malma. McPhail (1961) did not find any S. malma north of the Seward Peninsula in northwestern Alaska. During the 1968 studies gill raker counts were made in the field on three Wulik char. All had 10 gill rakers on the upper arch and 13 on the lower arch. The results of this cursory study are identical to the gill raker counts obtained by McPhail (1961) for S. alpinus collected at Point Hope.

Other Species Present in the Wulik River

Char are by far the most numerous fish in the Wulik River. In addition to char, two chinook salmon, Oncorhynchus tshawytscha, one coho salmon, O. kisutch, one chum salmon, O. keta, and two pink salmon, O. gorbuscha, were sampled from the native subsistence catch. Grayling, Thymallus arcticus, whitefish, Coregonus sp. (probably lavaretus), and Alaska blackfish, Dallia pectoralis, were also found in the Wulik. Alver-son and Wilimovsky (1966) found the whitefish species Coregonus autumnalis, C. sardinella, and C. lavaretus pidschian during their 1959 investigations of the southeastern Chukchi Sea. These species are likely to be present in the Wulik River.

Wulik River Subsistence Fishery

Wulik River char are one of the main sources of food for the native residents of Kivalina (approximately 160) and their sled dogs (approximately 270). Except for late July and early August, subsistence fishing for Arctic char may occur throughout the year.

In the spring, char are taken with gill nets and on hook and line. Fishing coincides with the downstream migration of char to salt water, and most fishing is done in Kivalina Lagoon. According to Kivalina residents, this catch is usually quite substantial and may equal fall upriver seining in some years.

From late August until mid-September, char are again taken with gill nets in Kivalina Lagoon and in the lower Wulik. Late summer and autumn fishing coincides with the immigration of char from salt water. The bulk of the gill net fishing had occurred before this study began; therefore, very little reliable information was collected. It was learned, however, that ten gill nets from 30 to 50 feet in length with a stretch-mesh measure of 3 to 5 1/2 inches were fished from August 15 to September 18. One fisherman kept partial records. His records show that in 72 net hours 56 char with a total weight of 110 pounds were taken.

The most important subsistence fishery is the autumn seine fishery, which was closely monitored in 1968. Three one-day seine trips were made in early September. The crews traveled about eight miles up the Wulik River to fish and returned to the village in the evening. The combined catch for these three trips was approximately 1,704 char or approximately 4,000 pounds. On September 18, three crews left Kivalina for the upper Wulik. On September 19, the fourth crew left for upriver seining. It took one or two days travel to reach fishing sites. The locations of the native fishing camps are given in Figure 1. The methods and equipment used were essentially the same as those described by Saario and Kessel (1966). All upriver seining was completed by September 27, when the Wulik froze for the winter. The results of the 1968 subsistence seine fishery are summarized in Table 4. The length frequencies of the char caught by a crew fishing 26 miles upstream are presented in Figure 2. An estimated 120,277 pounds or 49,512 fish were taken by seining. Except for a few grayling (approximately 400), whitefish (less than 100), and salmon (less than 25), the figures in Table 4 are for char. The 1968 seine catch is compared with the 1959 and 1960 catches in Table 5. According to the Eskimo natives, the 1968 seining was particularly successful. The bulk of the catch was stored in willow cribs constructed near the fish camps. This method of storing the seine catch was described by Saario and Kessel (1966). The stored fish are brought to the village by dog sled during the winter as demand warrants.

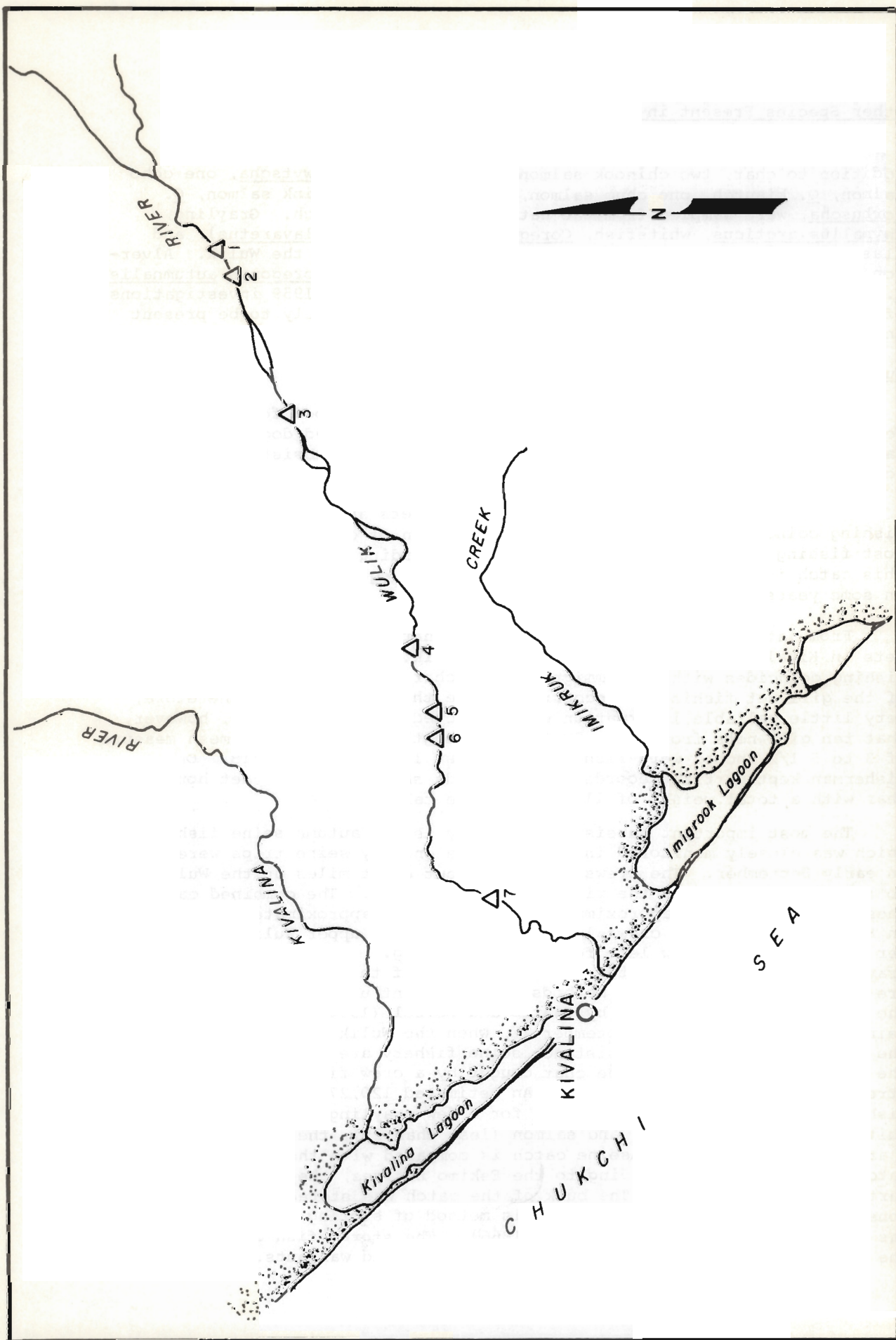


FIGURE 1. LOCATION OF NATIVE FISH CAMPS, $\Delta 1$ - $\Delta 7$.

TABLE 4 - Summary of Wulik River Native Subsistence Seine Fishery*, Autumn, 1968.

Fishing Site No. on Map	Approximate Distance from Village (mi)	Days Fished	No. Crew Members Engaged in Fishing	Length of Seine (ft)	Approximate No. Seine Hauls	No. Fish*	No. Lbs.
(Upriver)							
1	36	Sept. 20-22	5-7	100	6	7,892	19,500
2	34	Sept. 21-23	5-7	100	8	11,088	27,396
3	26	Sept. 19-21, 23-25	6-7	150	14	15,931	37,515
4	12	Sept. 21-25	6-7	150	12	10,395	25,684
5	10	Sept. 27	5-7	100	3	1,694	4,185
6	9 1/2	Sept. 27	5-7	100	2	808	1,997
TOTAL (Upriver)						47,808	116,277
(Downriver)							
7**	8	3 days late Aug. and early Sept.	5-7	100 & 150	6	1,704	4,000
TOTAL (From all Seining)						49,512	120,277

*Except for approximately 400 grayling, a few whitefish and salmon (king, coho, pink, and chum), the figures are for char.

**One day trips, crews returned to village in evening.

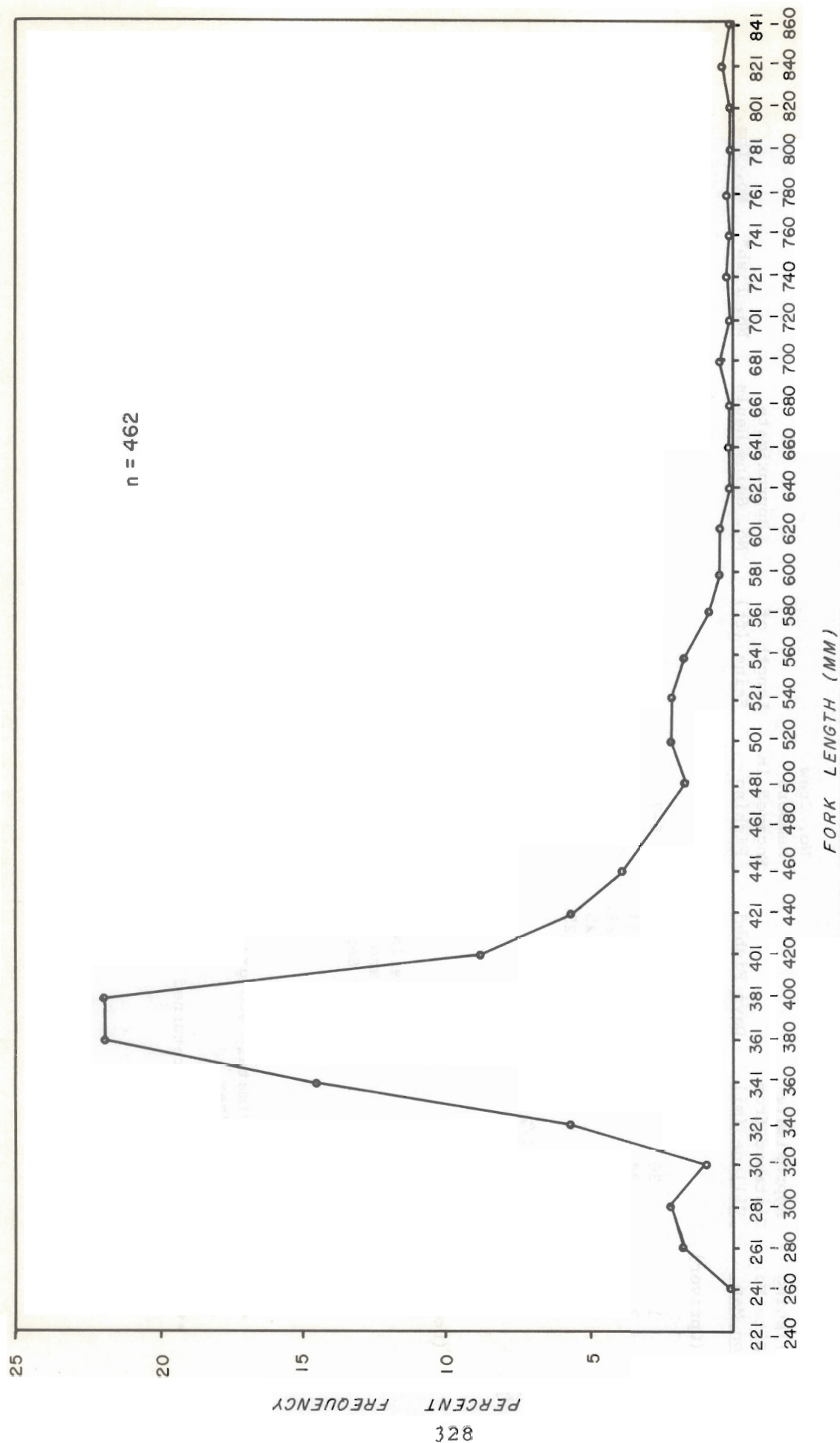


FIGURE 2. LENGTH FREQUENCY OF CHAR ENTERING NATIVE SUBSISTENCE CATCH AT A FISHING SITE 26 MILES UP THE WULIK RIVER, AUTUMN, 1968.

TABLE 5 - Comparison of Autumn Seine Catch of Char by Kivalina Natives for 1959, 1960, and 1968.

	<u>Total Pounds</u>	<u>Total Number</u>
1959**	97,600*	Not available
1960**	124,300	Not available
1968	120,241	49,512

*1959 catch includes an estimated 12,000 pounds of whitefish.

**From Saario and Kessel (1966).

Winter char fishing is also important to Kivalina. Three types of fishing are conducted: hook and line, gill netting under the ice, and trapping. Trapping by use of a weir and downstream trap installed in areas of open water was the most important method during the winter of 1968-69.

From October 1, 1968, to February 1, 1969, an estimated 2,106 pounds of char were taken by Kivalina fishermen. Saario and Kessel (1966) estimated the 1960-61 combined winter catch of char and grayling at 1,200 pounds.

Sport Fishery Kivalina Area

Because of their large populations of Arctic char, the Wulik and Kivalina Rivers have excellent sport fishing potential. The Alaskan record Arctic char (17.5 pounds) was taken in the Wulik. Due to their remote locations, comparatively few sport fishermen have fished these rivers. The Wulik is the more heavily fished because it is larger, has a much larger population of char and it has more gravel bars suitable for landing light aircraft. To estimate the sport fishing effort for 1967 and 1968 Kotzebue charter operators and sport fishermen were contacted. From the interviews it is estimated that 70 to 80 fisherman trips were made to the Wulik in 1967 and 50 to 60 in 1968. The lower number of fisherman trips in 1968 was probably due to unusually adverse weather conditions in September, as nearly all sport fishing occurs in the fall at the time of the migration of char from salt to freshwater.

Nome Area Char

In the Nome area, char are important sport fish especially in the late summer when they are present in most Seward Peninsula streams. They are also taken by subsistence fishermen and in small commercial operations. One fisherman took 350 pounds of char (all in the .5 to 2.0 pound range) from the Niukluk River near Council in December, 1968. These fish were sold to a Nome grocery store where they retailed in the round for \$.59 per pound.

Both Arctic char, Salvelinus alpinus, and Dolly Varden, S. malma, were found on the Seward Peninsula by Mc Phail (1961). From gill raker and pyloric caeca counts, a sample of two anadromous char taken in the Nome River and six from the Penny River all collected in September, 1968, were judged to be Arctic char. These fish ranged in size from .25 to 1.5 pounds and 255 to 390 mm, and all were immature.

TABLE 6 - Anaktuvuk Area Char Sample, 1968.

<u>Sample Number</u>	<u>Location Collected</u>	<u>Fork Length</u>	<u>Weight</u>	<u>Age Group</u>	<u>Sex</u>	<u>Maturity</u>	<u>Gill Raker Count (Upper & Lower)</u>	<u>Pyloric Caeca Count</u>
1	Grayling Creek	560	2.5	X	F	Spawned out	10 + 13	27
2	"	695	5.25	XII	M	"	10 + 12	26
3	"	535	3.0	XII	M	"	10 + 12	26
4	Ekokpuk Creek	264	.5	IX	M	Mature	8 + 13	24
5	"	245	.25	VI	F	Immature	9 + 13	22
6	"	275	.5	VII	M	Mature	9 + 14	24
7	"	230	.25	VII	F	"	10 + 10	23
8	"	246	.25	VIII	M	"	8 + 12	22

A sample of char collected from Sunset Creek by ADF&G personnel, John Burns and Ron Regnart, in October, 1963, was examined. These fish were all under 170 mm and most were sexually mature. Apparently the Sunset Creek char are non-migratory. More taxonomic study is necessary before it will be possible to determine the species of these fish.

Anaktuvuk Area Char

Eight char collected from the Anaktuvuk Pass area by Department Parasitologist Ken Neiland on October 15 and 16, 1968, were sampled. Results are presented in Table 6.

Sample numbers 1 to 3 were taken from Grayling Creek, a tributary of the Colville River. These fish were probably anadromous Arctic char, S. alpinus.

Sample numbers 4 to 8 were taken from Ekokpuk Creek, a tributary of the John River. The Anaktuvuk Eskimos call these Angayukaksurak ("old man fish"). Walters (1955) suggested that the "old man fish" of Anaktuvuk Pass "represent a morpho or a distinct species of Salvelinus".

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